become so excessive that we are no longer at liberty to treat the number of gaseous molecules present in the apparatus as practically infinite   and, according to Professor Clerk Maxwell's theory, the mean length of path of the molecules between their collisions is no longer very small compared with the dimensions of the apparatus.

The degree of exhaustion at which an induction-current will not pass is far below the extreme exhaustions at which the logarithmic decrement falls rapidly.

The force of radiation does not act suddenly, but takes an appreciable time to attain its maximum—thus proving, as Prof. Stokes has pointed out, that the force is not due to radiation *directly* but *indirectly*.

In a radiometer exhausted to a very high degree of sensitiveness, the viscosity of the residual gas is almost as great as if it were at the atmospheric pressure.

With other gases than air the phenomena are different in degree, although similar in kind—aqueous vapour, for instance, retarding the force of repulsion to a great extent, and carbonic acid acting in a similar though less degree.

The evidence afforded by the experiments of which this is a brief abstract is to my mind so strong as almost to amount to conviction that the repulsion resulting from radiation is due to an action of thermometric heat between the surface of the moving body and the case of the instrument, through the intervention of the residual gas.   This explanation of its action is in accordance with recent speculations as to the ultimate constitution of matter and the dynamical theory of gases.

XI. " Note on certain unusual Coagulation-appearances found in Mucus and other Albuminoid Fluids."   By CHARLES CREIGHTON, M.B., M.A.   Communicated by Prof. HUXLEY, Sec. R.S. Received June 9, 1876.

The following observations were made in the course of re-examining a number of microscopic preparations that had been originally made for other purposes.   They relate to certain unusual coagulation-forms that mucous or colloid or other albuminoid fluids assume when they are treated in a particular way.

In an early investigation of Virchow's ('Ueber die Form des geronnenen Faserstoffs') the production of the fibrinous threads of a coagulum was attributed to the contraction of the clot towards particular points, and was compared to the process of crystallization.   " We may consider," says Virchow, " this process to be a kind of *organic crystallization*, wherein each separate fibril must be viewed as a complex of smaller crystalline particles.   As in crystallization, so likewise in this case the separate molecules arrange themselves in particular directions to form delicate

columns, in which, however, no characteristic surfaces or angles can be discovered even with the highest magnifying-powers. . . . . In the case of mucus we have an appearance quite similar.   The solidified jelly-like mucus is entirely homogeneous and hyaline; and only in the direction in which it is stretched, dragged, or torn does it show folds and markings, and, according to circumstances, even a network—an actual division into filaments or bundles.   But if it is brought to coagulate by means of water, still better by means of alcohol or acids, the coagulation is fol- lowed by a shrinking, through which actual fibrils may result"*.   The coagulation-appearances now to be described will be found to favour the analogy with crystallization.   These exceptional coagulation-forms are also interesting as having recently been mistaken for something quite different.   This mistake, which has greatly contributed to the spread of a reactionary and superficial pathology, will be referred to at the end of the note.

The mucus on which the observations have been made occurred in the acini and ducts of mammary glands of the bitch and cat, in the alveoli of the thyroid body, and in the alveolar spaces of two extensive colloid or myxomatous tumours that grew from bone or periosteum; the mam- mary gland is known to produce mucus as a normal secretion under certain circumstances †.   The same appearances have been found also among the coagulated plasma with which the veins of a lymphatic gland were filled.   The appearances found in these cases seem to depend on the mode of preparation, which was essentially the same in them all. The portions of gland or other mucus-containing tissue were immersed in the hardening fluid as soon as they were removed from the body and while they were still warm.   The hardening fluid was either a $\frac{1}{6}$ per cent. solution of chromic acid, or the same solution mixed with an equal quan- tity of methylated spirit.

The preparations of the thyroid body are the best adapted to show the whole series of coagulation-forms and the gradations between them.   A large number of the alveoli are filled with perfectly homogeneous or jelly-like coagulum, which has coloured purple with the logwood staining- fluid.   The edge of the coagulum is very often vesiculated in such a manner that it seems to be attached to the wall of the alveolus by the points of crescent-shaped indentations.   The same dentate edge of the coagulum is often seen within the veins in chromic-acid preparations. The form of coagulation in the thyroid that comes nearest to the homo- geneous is where a number of fine granules appear to be imbedded in the jelly-like mucus; this produces a cloudy or spawn-like effect.   Side by side with these alveoli occur others, in which the coagulum is nothing but a closely packed mass of granules without connecting substance; and

* Gesammelte Abhandlungen, pp. 66, 67.

† See the writer's paper on " Physiological Processes of the Mamma" in the Report of the Medical Officer of the Privy Council for 1875.

these granules vary much in size in different alveoli. In some the co-
agulated mucus becomes finely divided, while in others it is broken up
into only a few rounded masses of relatively large size. Perhaps the
commonest size of the globules or granules of mucus is about one third
the diameter of the red blood-corpuscle, while the largest masses may
be twice its diameter. All the other coagulation effects can be shown to
be modifications of the granular condition; they range from not very
complex groups of granules or spherules to a close meshwork, and to
long branching filaments like the threads of ordinary fibrin. Many
alveoli of the thyroid body show the simpler reticular arrangements of
the coagulated mucus; the more complex reticular appearances are best
seen in two preparations of the mammary gland with mucus in the
ducts; and the filamentous appearance is best seen in the large colloid
collections that occur throughout the two myxomatous tumours. The
mucus in the mammary ducts has the following singular appearance:—
Along both sides of the duct there is a strip of homogeneous mucus which
adheres to the wall by means of the dentate points already mentioned;
further towards the centre of the duct the mucus is broken up into a
mass of granules; and the broad central space is occupied by a network,
the meshes of which become larger towards the middle. The appearance
looks as if it had been produced by a shrinking of the mucus towards the
sides of the duct. The fibres of this reticulum are short and thick, and
there arise from them numerous knob-like projections, chiefly at the
points where the fibres seem to branch; and where the fibres seem in the
section to end, their free extremities are found to be capped with the
same knob-like enlargements. These round processes are of the same
diameter as the threads or cords on which they are seated. The substance
of the whole reticulum is uniform, and is coloured throughout with the
staining-fluid.

The plan of this singular arrangement becomes clear by studying the
simpler forms of it, as seen in the alveoli of the thyroid body. Several
granules or spherules of mucus are found to have arranged themselves like
a group of crystals. Round a central spherule three or four others (as it
appears in the section) are regularly grouped to form a small rosette.
When several of these rosettes are placed in apposition, the optical effect
is that of branching cords or fibres with knob-like projections arising
from them at short and equal intervals. The appearance of a nodulated
fibre is best seen where the elements composing it are small. The smaller
the granules or spherules are, the longer do the intervals seem between
the upright knob-like projections; but if the focus is altered, there come
into view other projections arising along the course of the apparent fibre
at other angles or in other planes.

The common starting-point of the various coagulation-forms that have
been described appears to be that, under the influence of certain re-
agents, the warm albuminoid fluid is deposited in the form of larger or

smaller droplets or granules. These droplets, which are analogous to the crystals deposited from a crystallizing solution, are sometimes found of considerable size among the homogeneous mucus : in many cases the whole coagulum is granular, the granules remaining closely packed together; but they sometimes group themselves at certain points in the field, leaving free spaces between the groups, and these groups have each something of the regularity of a rosette of crystals. The clusters of granules further assume more of a reticular arrangement or more of a linear, according to circumstances.

The plasma of the blood is found sometimes, in chromic-acid preparations, to assume the same coagulation-forms as those just described and explained for mucus ; the necklace-like or nodulated fibres are obviously a modification of the ordinary fibrinous filaments of blood-clot.

The appearance described above of a reticulum of structureless or jointed filaments with knob-like projections arising at short intervals along their course and at their free extremities is precisely the same appearance as Dr. E. Klein found within the vesicles and pustules, as well as in the lymphatics, lymphatic spaces, and veins in the skin of sheep infected with variola (Transactions of the Royal Society, vol. clxv. pt. 1, p. 233 *et seq.*). The figures 11, 17, 18, and 19 of Dr. Klein's paper represent appearances that cannot be distinguished in any point from the particular coagulation-appearances that were found in the ducts of the mamma above described. The figs. 10 and 16, showing the more attenuated filaments with the knob-like projections at wider intervals, correspond to the coagulation-forms that were found chiefly in the colloid tumours. There can also be no doubt that the granular masses represented in figs. 7, 8, 9, and 13 of Dr. Klein's paper are the same forms of granular coagulation as those described in this note ; Dr. Klein has himself noted the occurrence of the granular substance side by side with and passing gradually into the filamentous (p. 241). While there is, on the one hand, a remarkable resemblance as regards form between the various appearances figured by Dr. Klein and the various coagulation-appearances herein described, there is, on the other hand, an essential similarity in the circumstances under which they occurred in the respective cases. In the case of the sheep-pox preparations, the appearances were found either in vesicles that contained a coagulable fluid, or in lymphatics and interfascicular spaces that were distended by œdema, or in veins. The portions of skin were immersed, while still warm, in the hardening fluid, which was sometimes a weak solution of chromic acid and sometimes methylated spirit (p. 219). Chromic-acid preparations alone seem to have been used for studying that stage of the disease in which the vesicles and pustules are completely formed (pp. 219, 230).

Now, although Dr. Klein considered that he had before him in these

preparations the various conditions of a fungus, to which he gave a generic and a specific name, and although he professed to find the various conditions of spore, mycelium, and fructification occurring in their natural sequence, and that natural sequence to correspond with the regular advance of the pathological process, there is no doubt that this circumstantial account rests on erroneous observation and on defective evidence, and that the appearances found in the skin of the sheep are none other than those resulting from the coagulation of albuminoid fluids under particular circumstances.

XII. " Determination of Verdet's Constant in Absolute Units." By J. E. H. Gordon, B.A., Gonville and Caius College, Cambridge.—1st and 2nd Memoirs. Communicated by J. Clerk Maxwell. Received June 5, 1876.

(Abstract.)

[*Note*.—The whole of this work has been done under Prof. Clerk Maxwell's superintendence ; he suggested the method and nearly all the details. He is, however, in no way responsible for any errors there may be in the numerical results.]

Introduction.

In the year 1845 Faraday discovered that if plane polarized light passes through certain media, and these media be acted on by a sufficiently powerful magnetic force, the plane of polarization is rotated.

About the year 1853 M. Verdet commenced a long and exhaustive examination of the subject, and his first result (published 'Ann. de Chimie et de Phys.' 3 série, tom. xli.) was that, for any given magnet and medium, " the ratio between the strength of the magnet and the amount of rotation is constant" *.

The object of the present research is to determine this constant in absolute measure—that is, in the C.G.S. system.

In order that the measurements may be expressed in absolute units, it is necessary to modify M. Verdet's mode of proceeding in several respects. In particular, an electromagnet with an iron core is unsuitable for this investigation, for both the amount and the distribution of the magnetic force between the poles depend on the properties of the iron core, and cannot be deduced from the strength of the current in the helix. Faraday's heavy glass and other media having the highest power of rotating the plane of polarization were also unsuitable to be used as standard media, on account of the difficulty of procuring specimens exactly alike. The following method was therefore adopted :—

The magnetic force was produced by means of an electric current in a

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* This is expressed much more fully in Maxwell's 'Electricity,' vol. ii. p. 400, art. 808. The coefficient mentioned in the last line of the article may be defined as Verdet's constant. In the author's larger paper the identity of the two definitions is shown.